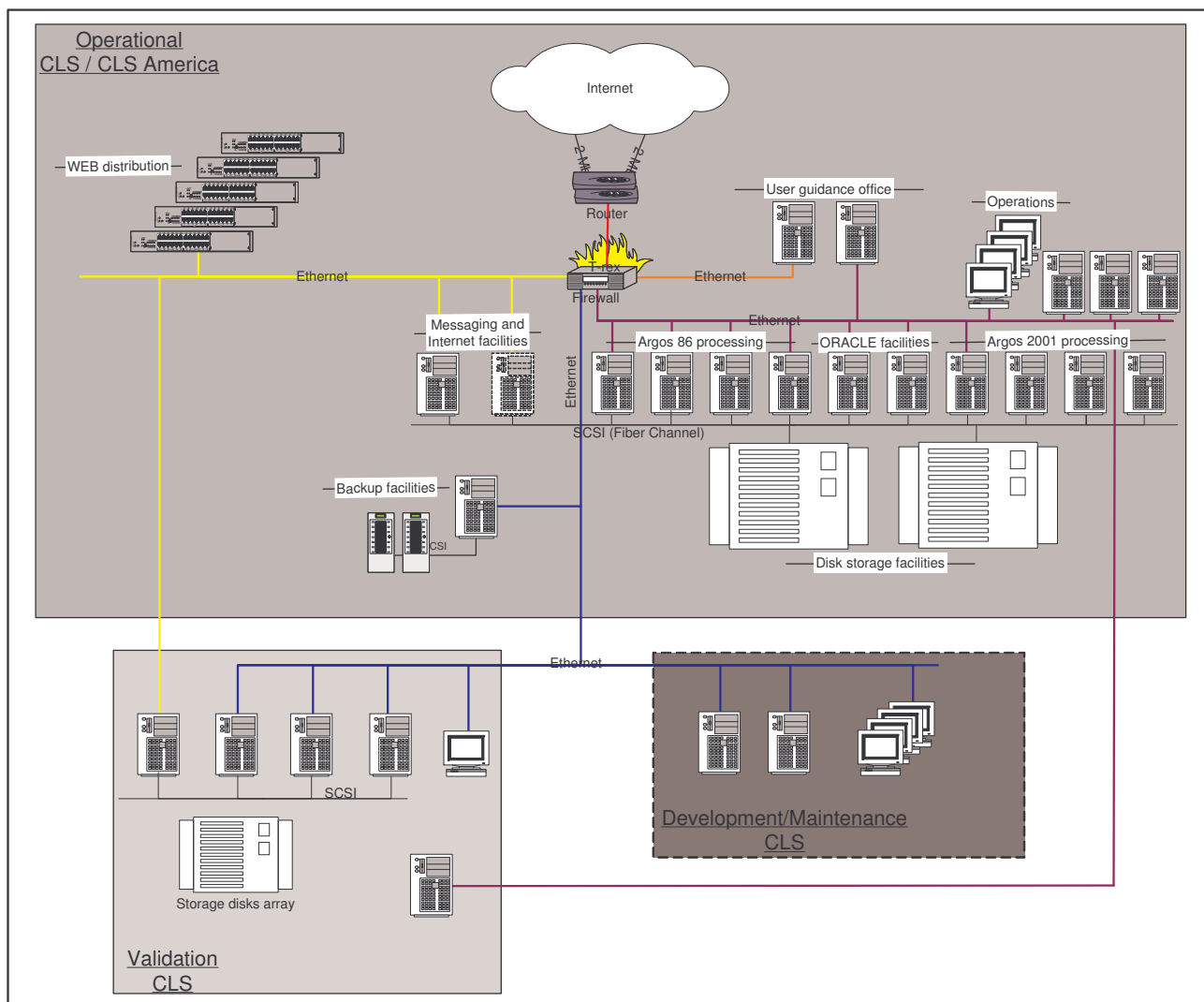# SYSTEM IMPROVEMENTS

1. Hardware configuration

The architecture implemented in 2004 for the Argos 2001 application has been slightly modified to add three new Linux servers to run the software associated to the phase 3 of Argos 2001.

Except our system of data backup which has been renewed and also our local network which has been upgraded, no other improvement has to be notified.

In 2005, we planned to implement our project of "Disaster recovery plan". Unfortunately, the second computing room which should house a part of our computing facilities has not been available in 2005. The project has been delayed to 2006.

2. Ground segment

The ground segment architecture is constantly upgraded to improve the reliability and quality of the offered service as well as the addition of new functions. The ground segment is made up of:
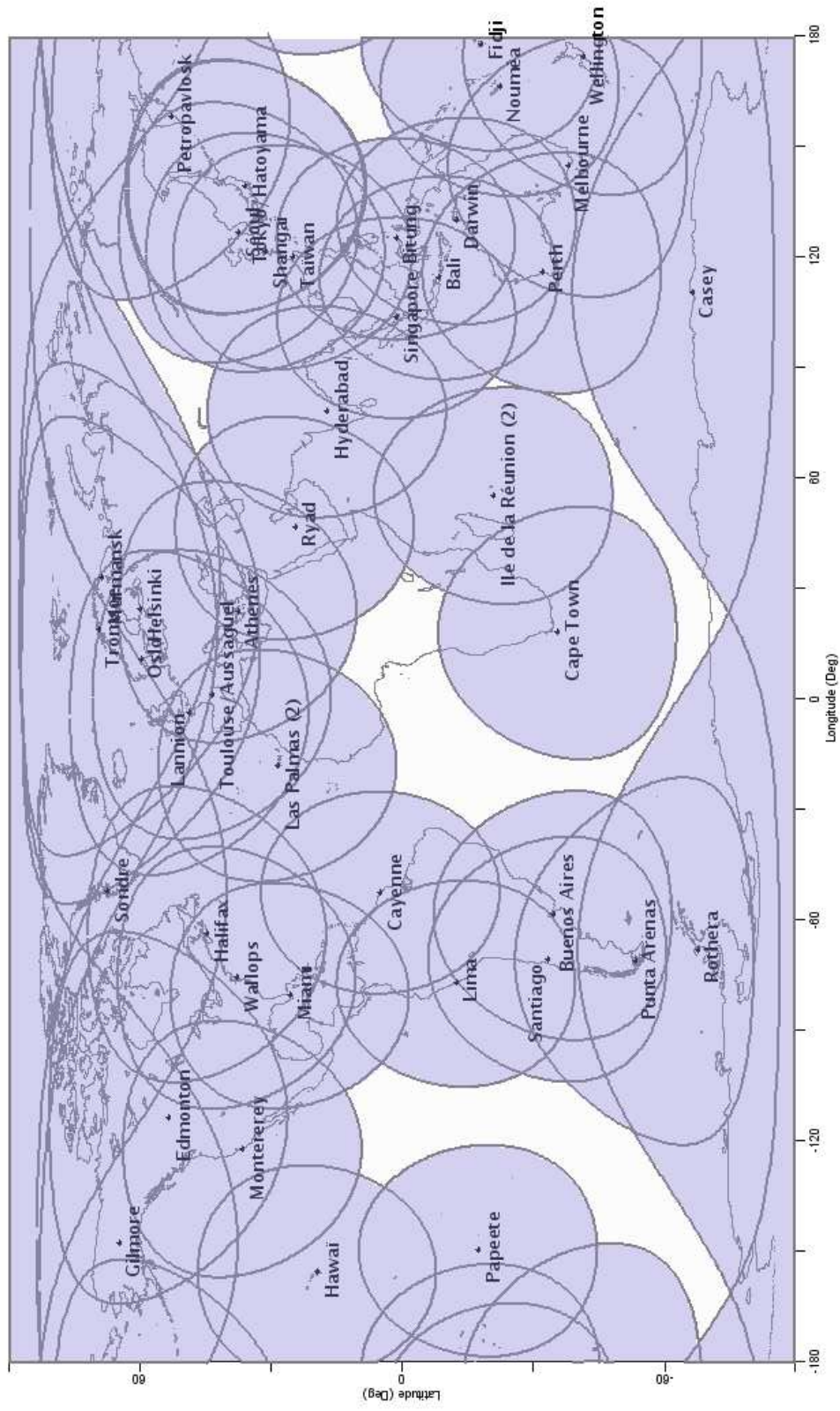
- the real time acquisition network,
- the Global Argos Control and Processing centre,
- the regional processing centers,
- the PTT and PMT.

2.1. Real Time Acquisition network

Four new stations joined the Argos network during the year. They are in Hyderabad (India, Incois), Seoul (South Korea), Shangai (China, East China Sea Fisheries Research Institute) and Tahiti (French Polynesia, Meteo France).

The Argos stations network has now 46 antennas.

Year 2005　Month 12

Gilmore
Tromsø Murmansk
Oslo Helsinki
Edmonton
Lannion
Sondre
Monterrey
Halifax
Wallops
Toulouse Aussaguel
Athenes
Miami
Las Palmas (2)
Hawaï
Cayenne
Lima
Santiago
Buenos Aires
Papeete
Punta Arenas
Rothera
Cape Town
Ile de la Réunion (2)
Ryad
Hyderabad
Petropavlosk
Hatoyama
TsuKuba
Shangai
Taiwan
Singapore Bitung
Bali
Darwin
Perth
Melbourne Wellington
Fidji
Nouméa
Casey

Longitude (Deg)
Latitude (Deg)

1

2.2. Argos Control and processing centre

The Global Argos Control and Processing centre is mainly improved through two projects:
- A2001 project (see chapter 2.2.1),
- Argos 3 ground Segment project (see chapter 2.2.2).

The figure below gives an overview of all components and interface of the processing center that have been added or modified during the development described in the following paragraph.
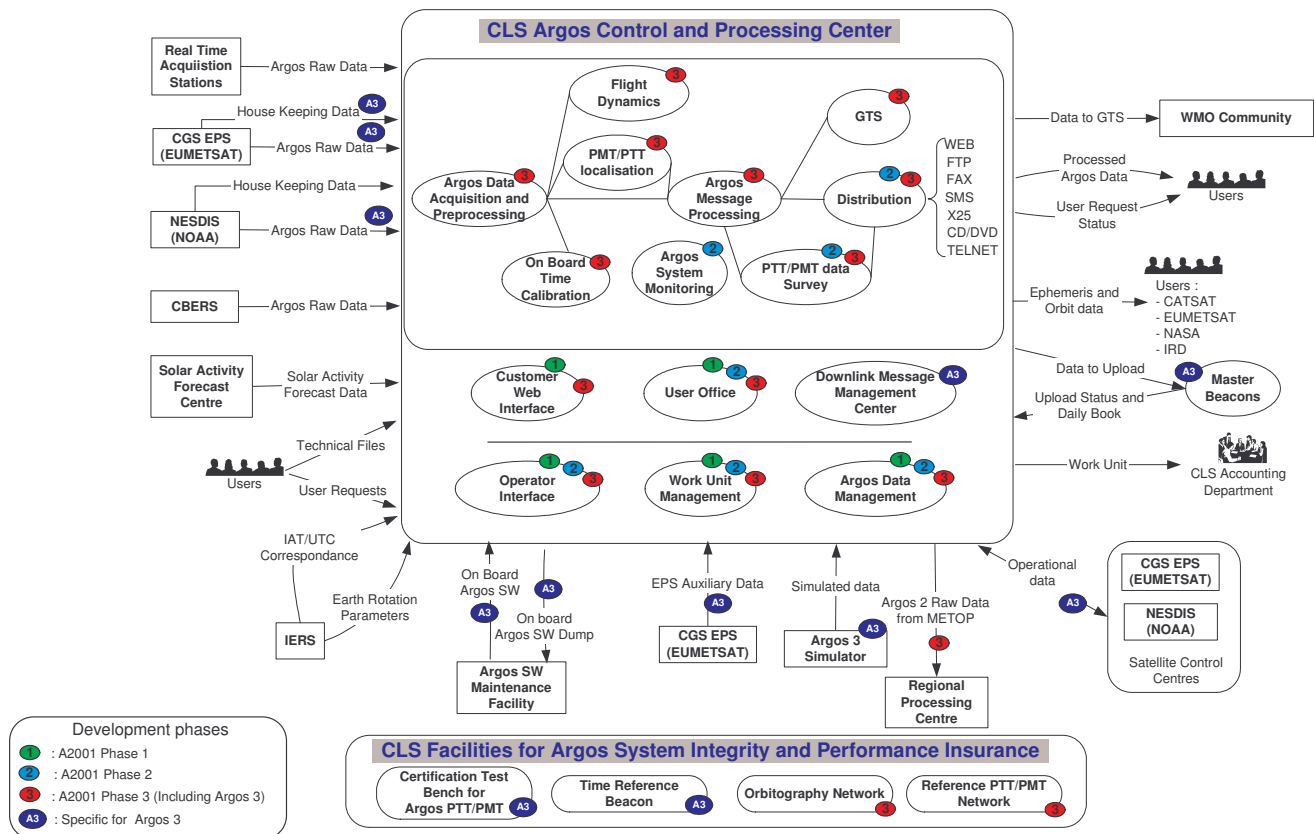
2.2.1 Argos 2001

The purpose of the Argos 2001 project is to upgrade the entire Argos processing system. This ambitious project is vital for the long-term continuity of the Argos system and to better serve users.

This project is scheduled in three phases:

Phase I: Development and implementation of a new user interface allowing users to access data and view and update technical files via a Web server. The System Use Agreements database will also be implemented during this phase. Data will be stored and managed by a database management system designed to be responsive to users' needs. Our objective is to give users more versatility if they require. Consequently, we will be expected to offer them quick and efficient support.

Phase II: Improvement and development of value-added services.

Phase III: Redesign of the Argos processing system. This phase has been subdivided into 2 sub phases:
- IIIA : Redesign of Argos processing chain
- IIIB : Redesign of GTS processing chain

Current status:
Phase I:
Development began end 1998 and is finished.
The user management application is operational.
The User Office application is operational since end of 2000.
The problems of performance in the new data distribution system have been solved. The opening of the website to the users has been made in May 2003.

Phase II:
Requirement specifications were reviewed and approved in January 2002.
Software specifications have been finished in July 2002.
The development have been commence in December 2002.
The development has been completed in may 2004.
This phase has been put in operation in May for CLS and has been put in operation in July for SAI.

Phase III:
Requirement specifications have been reviewed in July 2003.
The development has been started end of 2003.
The Software Specification Review of phase IIIA took place in May 2004.

The final acceptance test of the phase IIIA (Argos processing Chain) and IIIB (GTS processing Chain) has been pronounced in mars 2006. The technical qualification for the complete ground segment has been started in January 2006 and will be finished in July 2006. The operational qualification only for ACQ/PTR process has been started in April 2006. The operational qualification for complete ground segment will be finished at end of august 2006.
The phase IIIA will be put in operation in September 2006. The phase IIIB will be put in operation at end of 2006.

2.2.2 Argos 3 ground segment (SSA3 project)

In March 2003 started a new and major project for Argos named: SSA3 (Argos 3 ground segment). This project is aiming to take into account all the changes in the current Argos ground segment brought by the third generation of Argos instruments. It includes the downlink and the new format for the uplink messages (new modulation, high bit data rate…) as well as the interface with EUMETSAT.
The sub-systems of the Argos 3 ground segment development shall be completed and validated for the first METOP satellite launch which will be called METOP A. This launch is foreseen on July,17 2006, the Argos 3 instrument will be switch on 11 days after.

This project is driven in parallel with the Argos 2001 Phase III project and then the first milestone is now the delivery of the Argos 2001 phase III delivery which is scheduled in early 2006.

The Project covers the following developments:

- Software evolutions of the Argos Control and Processing Center (APC). It includes all sub-systems modified due to the Argos 3 capabilities and characteristics,
- Time Reference Beacon,
- A new network of master beacons (High data rate platforms),
- Argos PTT/PMT test bench.

- ***Argos Control and Processing Center***

The Argos Processing center is made up of several sub-systems. Each sub-system follows its own life cycle driven by the needs in terms of integration and validation of the center. These subsystems are:
  o ACQ/PTR: it is responsible for the acquisition of the mission telemetry from the regional antenna or the global receiving stations. Once acquired, the telemetry is processed in order to provide the other subsystems with "clean" and homogeneous Argos telemetry.
  o LOC: it is in charge for the determination of the plate-form localization by using the frequency measurements made by the instruments.
  o DAT/ORB: The relation between the on board time and UTC, used to time stamp the Argos messages, is assessed by the DAT subsystem. ORB is in charge of the production of ephemeris data used to localize the satellites.
  o TRM and GTS are two subsystems for which the evolution are mainly due to the objectives of the A2001 Phase III. It means to provide new capabilities to the users for encoding what they want to transmit through Argos.
  o DMMC: this sub-system is responsible for the management of the downlink message capability. Due to the failure of ADEOS II mission, this sub-system is now fully dedicated to Argos 3 instrument. The Specification Requirement Review took place on April, 29 2004. It has been fully delivered in September 2005.

The integration tests with EUMETSAT started in July 2005.. The data are now received from EUMETCAST.
The Integration, Validation and Verification phase started in April 2005. The full IV&V of the Argos 3 ground segment is done in parallel with the IV&V of the A2001 Phase III. It started in December 2005 and it is still in progress. All functions involved in Argos3 telemetry processing and downlink message management will be ready for the launch.

- ***Time Reference beacon***

A new generation of the Time Reference beacon has been specified to meet the new requirements of the Argos 3 instrument. The Factory Acceptance Test took place in June 2004. This beacon has been operational since April 2006.

- ***Master Beacon***

The Master Bacon, compliant with Argos 3 instrument, has been accepted by the CNES in March 2004. A master beacon was set up in Svalbard in September 2005. A second one will be installed at Fairbanks in June 2006.

- ***Certification Test Bench for Argos PTT/PMT***

This facility is used to check the new PTT/PMT series regarding the Argos general specifications in order to avoid that they disturb the on-board Argos equipment operations and the Argos system performance. The test equipment has been accepted by CNES and has been used as the nominal one since September 2005.

2.3 Regional processing centers

The three Argos regional centres (Lima – Peru, Jakarta – Indonesia and Tokyo – Japan) have been working properly in 2005. A few modifications have been made in 2005 to connect the regional centers to the new user guidance office only implemented in the global processing centres of Toulouse and Largo.

2.4 PTT/PMT for users

The Argos III Project includes a new key link between sensors and users. This new unit, also called PMT (Platform Message Transceiver), will work as a modem with the acquisition of data and their management to communicate with the satellite constellation. This management includes:
- the transmission of uplink messages using the satellite pass prediction attached with the compatible modulations,
- the reception and processing of the downlink messages (commands, predefines messages, satellite acknowledgement,…).
- the communication with the platform for the acquisition of sensors and the delivery of an acknowledgement when they have been all transmitted and ACK by satellites.

This new tool will give users new performances as soon as the satellite will be declared operational.

Using the feedback from ADEOS II, CLS has decided to run the "PMT Project" with two main targets.

The first one is to get some "PMT demo units" or first generation PMTs available as soon as the first Metop satellite will be declared operational.

The second one is to work on "Industrial PMT RF modules".

A. First generation PMTs

Very first PMTs were developed in 2002 / 2003 by Bathy Systems (Boston / USA) in collaboration with Seimac Ltd (Halifax / Canada), a major transmitter manufacturer. These units were working only on a BPSK 400 bits/sec. uplink and a BPSK 200 bits/sec. downlink. They were built around existing modules making the end product rather larger and expensive but fine to run demos. This work, as the collaboration between different manufacturers, gave us the opportunity to order in May 2005 a set of 80 of these "First generation PMTs " to Seimac Ltd with the implementation of some evolutions to take into account the Argos III new features.

These evolutions concern a new digital transmitter to run the PMT on both BPSK and GMSK modulations.

Seimac has already delivered a prototype unit of this PMT which is currently under

evaluation at CLS. A set of 80 units will be available by June 2006.
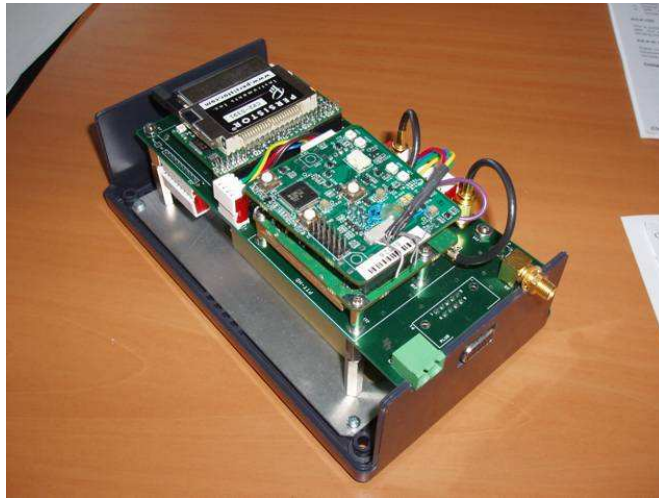
B. <u>Industrial PMT RF module</u>
Part of the success of the Argos III project will be based on the availability of low cost, low consumption and tiny "PMT RF modules". These modules correspond functionally to the previous first generation PMT demo units but designed "from scratch". In other words, instead of building a final product with the assembly of existing modules we propose to redesign the complete product to make it simpler on a single "electronic board". Doing so will certainly reduce the size, the cost, the complexity of the product (less controllers and interfaces) and the consumption.
This work started early in 2005 with some consultant studies on possible technical solutions as an analysis of the volume of the market.
The kernel of the product is clearly identified. It is made of a receiver, a transmitter, a relay to switch the unique antenna from the Rx to the Tx and a controller to manage the satellite protocol and to support the communication with the outside.
From a financial point of view it has been clearly underlined that the product should be manufactured at a unit cost close to 200€ to keep the final integrated product competitive regarding other existing solutions (Iridium, Inmarsat, Vistar,…)
 To cover this work, CLS issued late 2005 a Tender to select the best candidates for this development. Selection of providers was done late February 2006 with the election of Kenwood in Japan and Elta in France. Both companies presented to CLS an excellent and complete proposal (technical financial, quality,..). The plan is to get within a year (February 2007) tiny, low cost PMTs to provide to users as industrial Argos-3 solutions.